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(54) Package for electrical device

(57) A package for an electric device such as a surface acoustic wave filter or a semi-conductor device comprises a metallic cap 6 which is hermetically

sealed to a base 2 with an insulating (plastics) liner 5 or inner cover 7 within the cap 6 so that any minute metallic fragments which might drop off the cap as the result of mechanical shocks do not affect the characteristics of the device.

FIG. 1

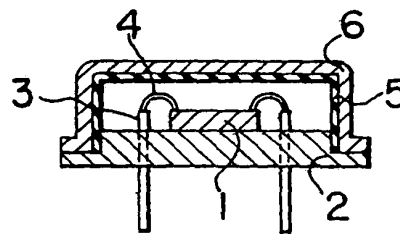


FIG. 2

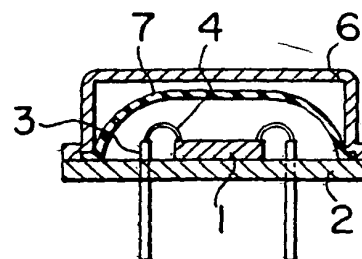


FIG. 1

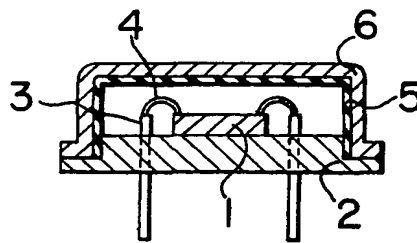


FIG. 2

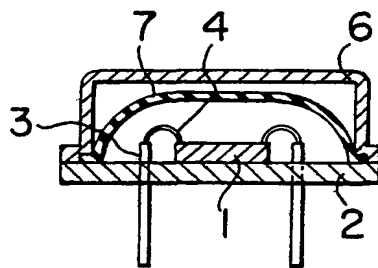
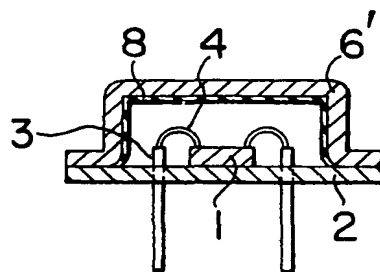


FIG. 3



SPECIFICATION

Package for electric device

This invention relates to packages needed for electrical elements, such as elastic surface wave filters which require to be isolated from ambient atmospheres.

An elastic surface wave element (hereinafter referred to as SAW element) is a solid state signal element comprising a substrate of piezoelectric material (e.g. LiNbO_3 and ZnO) and an interdigital transducer (hereinafter referred to as IDT) formed thereon, wherein the IDT is applied with electric signals for generating, by means of electro-mechanical conversion, elastic surface waves to be propagated on the free surface of the substrate and that electric signals can be produced by another IDT receiving the elastic surface waves. Since an SAW element inevitably requires to have a free surface (as a boundary condition, a stress is zero) for the SAW propagation, it is impossible to form a protective film such as passivation of chip-coating which is provided for semiconductor elements. For the SAW elements, it is necessary, therefore, to provide air-tight sealing to prevent formation of such a protective film.

For this purpose metallic packages are mostly employed as the most reliable sealing among various air-tight sealing method. However, metallic caps utilized for such packages have a disadvantage that metallic flakes scale off the internal surfaces of the caps. Although these caps are formed by being pressed out of sheet metals and plated, there occur burrs being produced during press forming and plating materials remaining thereon. Such small metallic fragments (5—10 μm in length) scales off the internal surfaces by mechanical impacts and drop onto the elements or chips. Since the inter-electrode distance (5—12 μm) of the SAW element is of the same order as these metallic fragments (5—10 μm in length), dropped fragments may cause pattern shorts in the SAW element, thus degrading the desired filter characteristics thereof.

An object of this invention is to provide packages for electric elements capable of preventing degradation in the characteristics of the elements caused by small metallic fragments which scaled off the metallic cap therefor.

In order to accomplish the above object of a package for air-tightly sealing an electrical element mounted on a stem by means of a metallic cap, there is provided an insulator member which is positioned between the electric element and the metallic cap to prevent small metallic fragments from scaling off the cap, thereby preventing them from falling on the electric element.

The present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a vertical cross sectional view of an embodiment of the invention;

Figure 2 is a vertical cross sectional view of another embodiment of the invention; and

Fig. 3 is a vertical-cross sectional view of still

another embodiment of the invention.

Fig. 1 is a cross sectional view of an embodiment in which an insulator casing is engagingly fitted on the internal surface of the metallic cap used. In this Figure, a substrate 1 of LiNbO_3 is die-bonded to a stem 2 by silver paste, and an aluminium electrode on the substrate 1 is wire-bonded with a lead post 3 of the stem by a gold wire 4, and then these members are covered with a metallic cap 6 having an insulator casing 5 on its internal surface, the stem 2 and the metallic cap 6 being then hermetically sealed by welding.

Fig. 2 is a cross sectional view illustrating another embodiment in which the above mentioned members are covered with an insulator casing before they are air-tightly sealed by the metallic cap. In this Figure, reference numbers identical with their respective members of Fig. 1 designate the same elements. As shown in the Figure, a dome of a plastic cover 7 is overlaid over the substrate 1 and is secured by the metallic cap 6, and then they are hermetically sealed.

Fig. 3 is a cross sectional view of still another embodiment in which an insulator plastic film is formed on the internal surface of the metallic cap before the cap is used for air-tight sealing. Also in this Figure, reference numbers identical with those of Figs. 1 and 2 are designated to show the same elements, and cap 6' is a metallic cap formed with an insulator plastic film 8. Such an insulator plastic film 8 can be formed by one of the following methods:

(a) Spray method in which a plastic material is sprayed on a metallic cap which is masked over regions (areas to be welded with the stem 2) where such insulation is not required.

(b) Dip method in which a metallic cap is dipped in a plastic material and then taken out of it.

(c) Spinning method in which drops of low-viscosity silicon plastic is applied to the center of a cap, which is then spun about its central axis to cover the internal surface of the cap with the plastic.

Since small metallic fragments scaling off the metallic cap 6 or 6' are prevented from reaching the base 1 by either the insulator casing 5, the plastic cover 7, or the insulator plastic film 8, pattern shorts can be prevented if such a metallic cap is used to isolate and seal the members from the ambient atmosphere. If small fragments of the insulator casing 5, the plastic cover 7, or the insulator plastic film 8 should scale off onto the substrate 1, they would give no influence to the substrate 1 since they are insulators and very light.

It is apparent that although the above applications are mentioned in connection with a piezoelectric element in the form of SAW element, the invention can be applied to semiconductor devices. As already mentioned, semiconductor chips are conventionally coated with insulator materials. In the production of such materials, however, a great amount of effort is required to reduce impurity ions in the materials whose

fragments might scale off and fall on patterns. The invention can also resolve this difficulty.

CLAIMS

1. A package for an electric device comprising:
- 5 (a) an electric element to be isolated from the ambient atmosphere;
- (b) a metallic cap air-tightly sealing said electric element and a stem;
- 10 (c) a sealing means being comprised of an insulating material which prevents penetration of small fragments, and sealing said electric element in such a condition that said sealing means shields said electric element from said metallic cap without contacting thereto.
- 15 2. A package for an electric device as defined in Claim 1, wherein said sealing means is tightly

fitted on the internal surface of said metallic cap.

- 20 3. A package for an electric device as defined in Claim 2, wherein said sealing means is made of a insulating plastic having low viscosity and coated on the internal surface of said metallic cap.

4. A package for an electric device as defined in Claim 1, 2 or 3, wherein said electric element includes a piezoelectric element.

- 25 5. A package for an electric device as defined in Claim 1, 2 or 3, wherein said electric element includes an elastic surface wave filter.

6. A package for an electric device as defined in Claim 1, 2 or 3, wherein said electric element

30 includes a semiconductor element.

7. A package for an electrical device substantially as hereinbefore described with reference to and as shown by the accompanying drawings.